Horticulture Series No. 615 January 1991

EVALUATION OF PROCESSING TOMATO BREEDING LINES AND CULTIVARS FOR MECHANICAL HARVESTING AND QUALITY IN 1990

S.Z. BERRY, K. WIESE, T.S. ALDRICH & C.C. WILLER

Department of Horticulture
The Ohio State University
Ohio Agricultural Research & Development Center
Wooster, OH 44691

This page intentionally blank.

EVALUATION OF PROCESSING TOMATO BREEDING LINES AND CULTIVARS FOR MECHANICAL HARVESTING AND QUALITY IN 1990

S.Z. Berry, K.L. Wiese, A.D. Bisges, T.S. Aldrich & C.C. Willer

INTRODUCTION

Rainfall was above normal the early part of the 1990 season. Some early-planted fields were flooded and waterlogged fields had to be planted late. There were over 17,000 contract acres planted. Below normal temperatures and excess rainfall resulted in delayed and adverse ripening conditions with resultant poor fruit color development and increased fruit rot losses at harvest.

New planting practices, growing methods machine harvest-bulk handling and new processing technology require a continuous supply of better suited varieties for the industry to remain competitive. Ohio continues to be the second largest processing tomato production state in the United States. This breeding work continues to be directed with emphasis on improvement of the whole-canned tomato (whole-pack) and tomato suitable for diced product. Other needs of the canner are also being given attention in relation to development of improved varieties for the processor of various juice, sauce and paste products.

Selection for earliness and improved fruit setting ability, especially during periods of heat stress, is being carried out to reduce the problem of split fruit set and make possible more uniform tomato harvest schedules. Other important characteristics being selected to make machine harvest and bulk handling more efficient include crack resistance, firmness and ability of ripe fruit to store well on the vine for extended periods to allow maximum fruit recovery in machine harvest. Thus, in addition to increased productivity, a major objective is more effective utilization of yield already being attained, especially in regard to factors minimizing loss due to green, overripe and decayed fruit. Jointless pedicel (j2) is being utilized to facilitate machine harvest and allow harvest of fruit free of stems.

Improved quality factors being selected for and intensively evaluated for in cooperation with commercial processors include: acidity, pH, soluble solids, viscosity, color (crimson fruit color [og^c], and especially fruit attributes conditioning efficient lye or steam peeling characteristics and corelessness.

†Professor, Assistant Professor, Research Assistant, & Branch Manager

1/91-H-484/400

Ohio 7814 acreage continues to be substantial and is proving to be a valuable asset as an early-main season Fusarium resistant, jointless pedicel, machine harvest type with excellent firmness, holding ability and resistance to fruit rots. It is especially suited for coreless wholepack and diced pack, as well as pureed product manufactured.

The Ohio 7983 has been extensively evaluated and is very promising as an early, high quality machine harvest, jointless pedicel, whole-pack type similar to Ohio 7814. Commercial acreage of Ohio 7983 is increasing.

Ohio 7870 continues to be used as an main-early season Verticillium-Fusarium resistant, machine harvest cultivar. It exhibits excellent productivity and especially good fruit disease resistance and holding ability.

Ohio 8245 is a productive main season, jointless pedicel, machine harvest variety with Fusarium and Verticillium wilt resistance. It has excellent quality aspects for coreless wholepack, diced product, as well as processed product. It is being extensively grown and its use has greatly increased.

Ohio 8550 is a recently developed early-main season, jointless pedicel line with Verticillium-fusarium resistance. It has excellent quality for whole pack, diced product, as well as processed product. Seed is being increased in winter nursery and pilot commercial trials with grower-canners will be made in 1991.

Ohio 8556 is a new main season jointless pedicel line with Verticillium-Fusarium resistance. It has excellent quality for wholepack, diced product, and processed product. Seed increases in winter nursery and pilot commercial trials with grower-canners will be made in 1991.

Hybrid Ohio OX1 and hybrid Ohio OX4 are new developments with earliness, Verticillium-Fusarium wilt resistance, jointless pedicel and excellent productivity. They have excellent quality for whole pack, diced product as well as processed product. Seed is being produced and pilot commercial trials with grower-canners will be continued in 1991.

The use of hybrid processing tomatoes by the industry in Ohio has increased. Hybrids have exhibited potential for making possible improved productivity, disease resistance and quality; acreage planted with hybrids is increasing. In general hybrid cultivars do not produce large yield advantages when compared with open pollinated varieties, however, they can provide improved earliness and more dependable performance under stress conditions. In that hybrid seed production is a labor intensive manual operation such seed is more costly than that of open pollinated variety seed.

MATERIALS AND METHODS

Location: Vegetable Crops Branch, Fremont, Ohio.

Soil: Silty clay loam, fall bedded.

Fertilizer: 500 lb. per acre of 0-26-26, November; 200 lb. per acre of 34-0-0, April.

Herbicide: 4 lb/A Devrinol incorporated May 10; Sencor directed spray 0.5 lb./A June 26.

Plants: Greenhouse-grown, 108 per standard flat from seed sown April 6.

Transplanted to Field: May 22, a two-row transplanter using 21-53-0 starter at 5 lb. per 100 gal. of water; 1/2 pint per plant.

Plot Size and Spacing: Single-row plots, 20 plants per row spaced 12 inches, rows 5 feet apart.

Insect and Disease Control: Standard recommended program followed for insect and disease control.

Weather Data (Fremont, Ohio)

	Temperature		Rainfall (inches)	
	1990	38 Yr. Avg.	1990	38 Yr. Avg.
April	49.6	48.7	2.16	3.35
May	57.1	59.4	4.07	3.69
June	68.7	69.1	4.65	3.99
July	70.5	71.5	6.46	4.19
August	68.8	69.9	4.49	3.70
September	63.5	64.2	4.35	3.08

HARVEST INFORMATION

Above average rainfall and below normal temperatures resulted in some waterlogged soil conditions that limited root growth and caused some plant damage. Harvesting was with a Johnson tomato harvester and was carried out when the entries were estimated to be at a stage of fruit ripeness in which yields of marketable fruit were approaching optimum recovery with a minimum of green and cull fruit (Tables 1 & 4). Percentages reported of fruit recovery are on a weight basis.

The data for the new experimental lines is organized according to maturity groups and within maturity by once-over machine-harvest fruit yield (Tables 1 & 4). Because of the complexity of factors which determine a potentially successful variety, other factors which must be considered and that can be limiting are included; eg., fruit concentration, fruit cull percentage, fruit

size, stemming character, and jointlessness. To adequately evaluate promising lines at least one or two more years of testing will be necessary.

QUALITY EVALUATION

Field-run tomatoes were used for quality evaluation; the sample was cut in half, quartered, extracted in a Food Processing Equipment Co. laboratory pulper, and de-aerated (Tables 2 & 4).

1. Agtron E-5. Instrument calibrated at 48.
2. Hunter Color Difference Meter (CDM).
3. Percent Soluble Solids: Abbe Refractometer
4. Percent Total Acid as citric: The raw sample used for pH determination was directly titrated using 0.1 normal sodium hydroxide solution to a pH of 8.1.
5. pH was determined by the glass electrode method.
6. Viscosity potential; hot break-finish-capillary-60 second flow basis.

Seed Sources and Cooperators

1. S.Z. Berry, Dept. of Horticulture, OSU-OARDC, Wooster, OH.
2. L.R. Nelms, Campbell Soup Co., CIRT, Napoleon, OH.
3. F. Cortelyou, Hunt-Wesson Foods, Inc., Perrysburg, OH.
4. D. Ematty, H.J. Heinz Co., 13737 Middleton Pike, Bowling Green, OH
5. W. Springer, Terra-Vegetable Div., Carmel, IN.

TABLE 1. Trial I. Mechanical harvest evaluation of processing tomato varieties and test lines of harvestable fruit were approaching optimum recovery. Replicated. Vegetable Crops Branch, OARDC, Fremont, Ohio 1990.

Variety or Test Line	Ripe Usable T/A	% of Potential Ripe	Green	Cull	Fruit Wt. (oz.)	Stems (j2=jointless) (+ =jointed)
Harvest Date 8/28/90						
OX4	17.1	68	25	8	2.1	j2
OX3	16.2	72	25	4	1.8	j2
OX38	15.4	62	36	2	1.9	j2
07814	15.0	68	25	7	1.9	j2
088119	14.8	72	10	18	1.6	j2
OX7	14.2	74	24	2	2.1	j2
PS2196	14.0	64	33	3	2.0	j2
088144	13.9	61	34	5	2.0	j2
08383	13.2	60	22	17	2.1	j2
07983	13.1	66	19	15	2.0	j2
08986	12.7	64	26	10	2.0	+
08675	12.4	69	25	6	2.0	j2
08690	12.2	58	37	6	2.1	j2
PS1596	12.1	53	38	9	2.1	j2
08991	12.1	69	20	11	1.8	j2
087160	11.4	64	9	27	1.7	j2
CXN122	10.4	51	39	10	2.4	j2
Harvest Date 9/4/90						
OX2	24.3	78	15	7	2.1	j2
PS696	21.1	77	16	6	1.9	j2
08245	20.4	74	22	4	1.9	j2
088110	19.4	73	18	9	1.9	j2
OX1	18.9	74	8	17	2.1	j2
OX6	18.8	75	15	11	2.0	j2
088164	18.5	77	14	8	1.8	j2
08243	17.9	73	16	10	1.7	j2
OX5	16.7	68	19	12	2.1	j2
086120	15.6	71	17	11	2.2	j2
08446	15.5	68	19	13	2.2	j2
088169	15.1	79	9	12	1.9	j2
087175	14.9	76	10	14	1.9	j2
08994	14.8	58	33	9	2.6	+
08689	13.3	65	26	9	2.0	j2
088154	12.5	75	15	10	2.0	j2
08550	12.3	64	18	18	2.1	j2
08556	10.3	68	21	11	2.1	j2
LSD .05	4.8				0.2	

TABLE 2. Trial I. Laboratory evaluation of processing tomato varieties and test lines. Vegetable Crops Branch, OARDC, Fremont, Ohio, 1990.

Variety or Test Line	pH	% Citric acid	% Soluble solids	Hunter CDM a/b	Agtron
07814	5.2	0.27	3.3	1.2	47
07983	5.2	0.26	3.2	1.4	36
08243	5.3	0.26	3.7	1.4	12
08245	5.1	0.30	3.7	1.4	40
08383	5.2	0.30	3.1	1.5	39
08446	5.2	0.21	3.5	1.3	41
08550	5.3	0.25	3.6	1.3	43
08567	5.2	0.20	3.2	1.3	36
08655	5.2	0.27	4.1	1.6	38
08675	5.3	0.26	3.3	1.5	43
08687	5.2	0.28	4.0	1.5	32
08689	5.2	0.26	3.3	1.3	43
08690	5.3	0.23	3.7	1.5	39
08556	5.2	0.25	3.7	1.5	40
086120	5.2	0.26	3.4	1.3	42
CXN 122	5.2	0.28	3.8	1.3	36
087160	5.2	0.21	3.4	1.2	40
087175	5.3	0.26	4.6	1.7	35
088119	5.3	0.19	2.9	1.3	41
088122	5.3	0.25	3.3	1.4	48
088144	5.2	0.25	3.5	1.2	44
088110	5.3	0.24	3.4	1.3	38
088152	5.2	0.24	3.0	1.4	37
088153	5.1	0.28	3.1	1.4	38
088154	5.3	0.23	3.2	1.3	38
088164	5.1	0.25	3.7	1.3	41
088169	5.1	0.27	3.7	1.3	44
088176	5.3	0.30	3.7	1.5	42
08986	5.2	0.22	3.2	1.3	42
08991	5.3	0.23	3.2	1.1	47
08894	5.2	0.23	3.8	1.4	40
PS 696	5.1	0.27	3.4	1.3	39
PS 1596	5.2	0.26	2.9	1.4	38
PS 2196	5.0	0.30	3.0	1.3	38
OX1	5.4	0.25	3.4	1.4	42
OX2	5.1	0.25	3.4	1.2	45
OX3	5.1	0.24	3.2	1.4	38
OX4	5.1	0.28	3.3	1.4	38
OX5	5.3	0.25	3.2	1.3	40
OX6	5.2	0.30	3.0	1.4	40
OX7	5.2	0.27	3.8	1.4	39
OX8	5.2	0.28	3.4	1.3	37
OX9	5.1	0.28	3.3	1.5	37
OX38	5.2	0.24	3.4	1.3	42
OX49	5.1	0.28	3.1	1.4	39

TABLE 3. Trial I. Viscosity potential laboratory evaluation of processing tomato varieties and test lines. Vegetable Crops Branch, OARDC, Fremont, Ohio 1990.

Variety	Raw Brix	pH	Viscosity Potential Index Cases/Ton (72/8 oz sauce)
07814	4.0	4.2	31.87
07983	3.7	4.3	32.89
08243	3.8	4.3	34.91
08245	4.1	4.4	38.28
08383	4.2	4.4	37.18
08446	4.5	4.3	39.15
08550	3.7	4.4	30.16
08655	4.6	4.3	36.91
08675	4.5	4.5	33.11
08687	4.3	4.4	34.44
08689	3.7	4.5	29.29
08690	3.8	4.3	30.90
08556	3.8	4.3	28.79
086120	4.4	4.4	31.09
CXN122	4.3	4.4	33.76
087160	3.5	4.4	36.39
087175	5.1	4.5	36.68
088119	4.2	4.5	42.34
088122	4.5	4.4	34.21
088144	4.1	4.3	32.07
088110	4.1	4.4	39.15
088152	3.9	4.4	42.34
088154	3.5	4.4	37.45
088164	4.0	4.3	36.14
088169	4.1	4.4	29.46
08986	3.6	4.3	38.86
08991	3.9	4.3	44.14
08994	4.3	4.5	43.04
PS696	4.1	4.3	39.45
PS1596	3.6	4.4	36.91
PS2196	3.7	4.4	33.11
OX1	3.6	4.2	31.28
OX2	3.9	4.3	35.15
OX3	3.6	4.4	39.45
OX4	3.7	4.3	33.11
OX5	3.9	4.5	33.76
OX6	4.1	4.4	30.53
OX7	4.2	4.2	34.21
OX38	4.1	4.5	36.14

TABLE 4. Trial II. Mechanical harvest evaluation of processing tomato varieties and test lines of harvestable fruit were approaching optimum recovery. Non-Replicated. Vegetable Crops Branch, OARDC, Fremont, Ohio 1990.

Variety or Test Line	Ripe Usable T/A	% of Potential			Fruit Wt. (oz.)	Stems (j2=jointless) (+ =jointed)
		Ripe	Green	Cull		
Harvest Date 8/30/90						
OX1	30.7	74	22	4	2.5	j2
OX2	29.2	76	20	4	2.1	j2
OX32	28.8	78	17	5	1.9	j2
OX5	27.2	75	18	7	2.1	j2
090141	26.7	73	25	2	2.1	j2
OX4	26.6	78	8	13	2.1	j2
OX6	26.0	70	28	3	2.1	j2
Malinta	25.7	77	11	12	2.3	j2
OX35	24.1	87	10	3	2.3	j2
090137	22.4	75	9	16	1.7	j2
OX16	22.5	72	22	6	2.2	j2
088129	21.8	78	12	10	2.2	j2
07814	21.7	77	11	12	2.1	j2
090139	21.3	83	6	11	2.2	j2
088154	21.2	79	13	8	2.0	j2
OX34	21.2	81	12	7	2.3	j2
H7155	21.0	63	28	9	2.8	j2
OX17	20.3	74	17	8	2.3	j2
OX22	19.8	71	27	2	2.1	j2
08990	19.8	73	16	11	1.9	j2
OX38	18.7	77	3	21	1.8	j2
087173	18.5	74	9	17	1.7	+
H6285	18.0	68	21	11	2.5	j2
08673	14.7	76	14	10	2.1	j2
Easy Winner	13.5	73	14	13	2.3	j2
08383	11.2	58	17	26	2.3	j2
Harvest Date 9/11/90						
OX3	35.3	83	6	11	2.0	j2
OX33	28.1	81	10	9	2.6	j2
088198	26.6	78	16	6	2.1	j2
OX27	26.0	79	8	13	2.1	j2
PS696	25.9	80	6	15	2.7	j2
088174	25.4	75	19	6	2.3	j2
OX7	24.6	85	2	13	2.1	j2
07983	22.8	73	19	8	2.1	j2
090134	20.5	73	13	15	2.3	+
088123	19.7	83	4	13	2.2	j2
08988	19.7	72	16	12	2.1	j2
OX42	19.2	77	2	20	1.8	j2
08245	18.6	79	13	8	2.2	j2
OX9	18.0	80	2	18	2.4	j2
08556	17.9	77	8	15	2.5	j2
088165	16.1	71	17	12	2.9	j2
08696	15.0	75	10	16	2.2	j2
090135	14.6	66	29	5	2.0	j2
086137	13.6	71	13	16	2.0	+
08550	12.5	58	21	20	2.3	j2
088157	11.8	69	6	24	2.2	+

TABLE 5. Trial II. Viscosity potential laboratory quality evaluation. Vegetable Crops Branch, OARDC, Fremont, Ohio, 1990.

Variety	Raw Brix	pH	Viscosity Potential Index Cases/Ton (72/8 oz. sauce)
07814	4.4	4.2	33.76
07870	4.0	4.3	33.32
07983	4.1	4.2	35.15
08245	4.5	4.4	36.39
08383	4.3	4.2	35.39
08550	4.5	4.4	33.54
08556	4.3	4.5	29.29
0832	4.6	4.4	42.00
H6285	4.1	4.3	43.04
H7155	4.2	4.5	39.15
Malinta	3.8	4.5	37.18
Easy Winner	4.3	4.6	37.72
08673	4.1	4.5	32.89
08696	4.3	4.5	32.48
086137	4.1	4.5	36.14
087173	4.6	4.2	37.72
088129	4.0	4.2	36.14
088154	3.7	4.4	39.75
088157	3.7	4.5	-----
088165	4.2	4.4	30.90
088174	4.5	4.4	36.65
088198	4.3	4.2	33.76
08988	3.7	4.6	-----
08990	4.0	---	42.69
090134	3.7	4.5	33.32
090135	4.2	4.5	32.89
090137	3.7	4.3	39.45
090139	4.8	4.5	35.15
PS696	4.0	4.3	39.45
OX1	4.0	4.2	34.21
OX2	4.6	4.6	40.37
OX3	4.0	4.5	38.28
OX4	4.4	4.6	40.37
OX5	4.2	4.3	40.69
OX6	4.5	4.5	38.86
OX7	3.9	4.5	35.15
OX8	4.3	4.3	34.68
OX9	3.8	4.3	36.65
OX16	4.4	4.5	34.91
OX17	4.2	4.5	34.21
OX27	3.9	4.5	30.35
OX32	3.7	4.4	38.00
OX33	4.3	4.3	39.45
OX34	4.1	4.2	32.89
OX35	3.7	4.5	32.48
OX38	3.7	4.5	32.68
OX42	3.8	4.3	34.68
OX54	3.5	4.4	31.28

This page intentionally blank.

This page intentionally blank.

This page intentionally blank.